The potential risk induced by climate change in the context of mega-nourishments

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The beach nourishments make up for the lack of sand a beach experiences due to natural and human processes. Their increase in frequency and size in the last years is partly due to subsidence and sea level rise. Stive et al. (2013) proposed a mega-nourishment 10 to 100 times bigger than the traditional ones, the ZandMotor (ZM), to fight climate change. The ZM was designed with a 2.4 km width to work with the forces of nature (longshore sand transport induced by waves) diffusing the sand along 17 km.

Such a large nourishment changes the bathymetric lines, perturbing the typical wave transformation. The perturbation effect becomes more important with oblique-incident waves, reducing the diffusivity of the nourishment and even making the diffusivity negative (the nourishment amplitude increases instead of decreasing) for large-oblique-incident angles.

The objective of the present work is to study the importance of the incident-wave angles in the longterm (>30 yr) and the risk that a changing climate can have in such large spacial and time scales. For this we calibrate the Q2D-morfo a morphodynamic model (van den Berg et al., 2013), which is based in the longshore transport induced by waves, with 3-yr data of the ZM and speculate about the uncertainty of future wave climates.

We find that if the wave climate remains statistically similar to the present one the lifetime of the ZM is of 80 yr instead of the 20-yr-designed lifetime, a possible explanation for this difference is the effect of oblique waves given that 60% of them are very oblique. Secondly we find the critical future wave climate that unstabilizes the coast, generating large-scale oscillations in the Dutch coast.

van den Berg et al., Modelling large scale shoreline sand waves under oblique wave incidence.JGeophys.Res.,117(F03019),2012.
Stive et al., A new alternative to saving our beaches from sea-level rise: The sand engine. Coastal Eng., 29(5):1001–1008, 2013.

Preferència de presentació (marcar amb una X): Ξ Oral